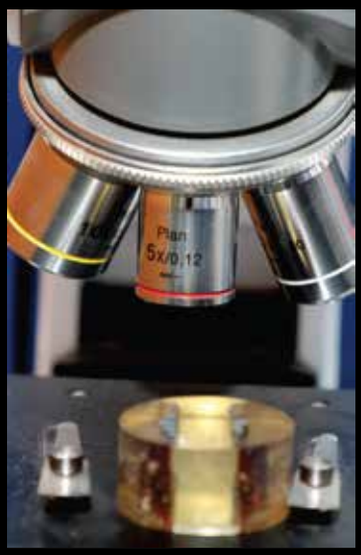
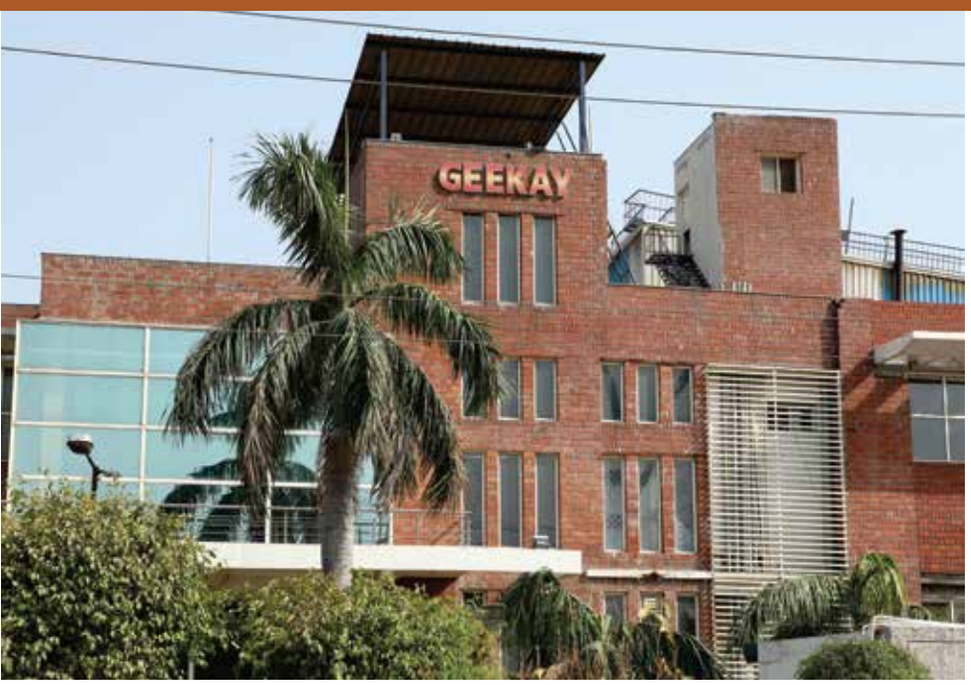
www.gkwinding.com



QUALITY THAT INSPIRES TRUST

GEEKAY
WINDING WIRES

Leader in Copper & Aluminum Enamelled Winding Wires



Established in 1975, G.K. Winding Wires Limited is the leading manufacturer of Copper & Aluminium Enamelled Winding Wires in India, marketed under its brand GEEKAY. The market for copper winding wires is over 3 lac MT per annum and we are one of the leading players in the organized sector.

We have 4 manufacturing units with 2 in Noida (U.P.), and one each in Baddi (H.P.) and SriCity (A.P.), giving us the unique advantage of being able to service customers across India and having proximity to the part to be able to serve international customers.

OUR MISSION

To always be at the core of our customer's business by adding value through our **systems driven**, **technology based** and innovative **solutions approach.**

OUR VALUES

TRUST
We are truthful and we make a promise to keep it.

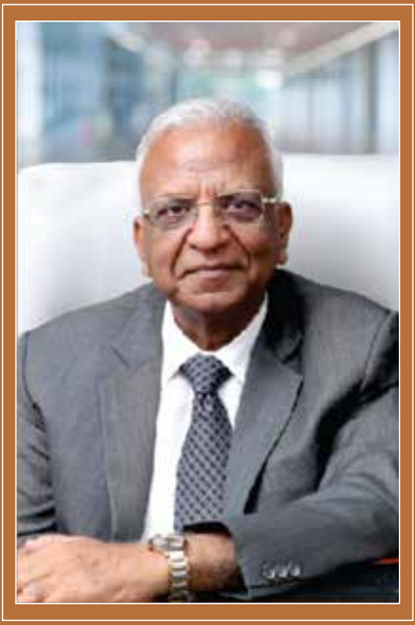
OWNERSHIP
We take ownership for our mistakes, and every team member has a high level of accountability.

ACTION ORIENTED
We follow up ideas with actionable points and follow PDCA to fine tune and get required results.

RESPECTFUL
Towards our people, our stake holders and the society.

LEARNERS
We are a learning organisation and we learn from our mistakes to be better everyday.

TEAM
We win when our team does.



Mr. Sudhir Agarwal is one of the earliest entrepreneurs in the metal products industry and founded G. K. Winding Wires Limited in 1975.

He has been the force behind establishing GEEKAY as one of the leading enamelled wire brands in India. He has been honored for his contribution to the industry by being elected as the chairman of WWMAI.

SUDHIR AGARWAL
Chairman & Managing Director
B.E. (MNIT, Jaipur – Batch of 1970)

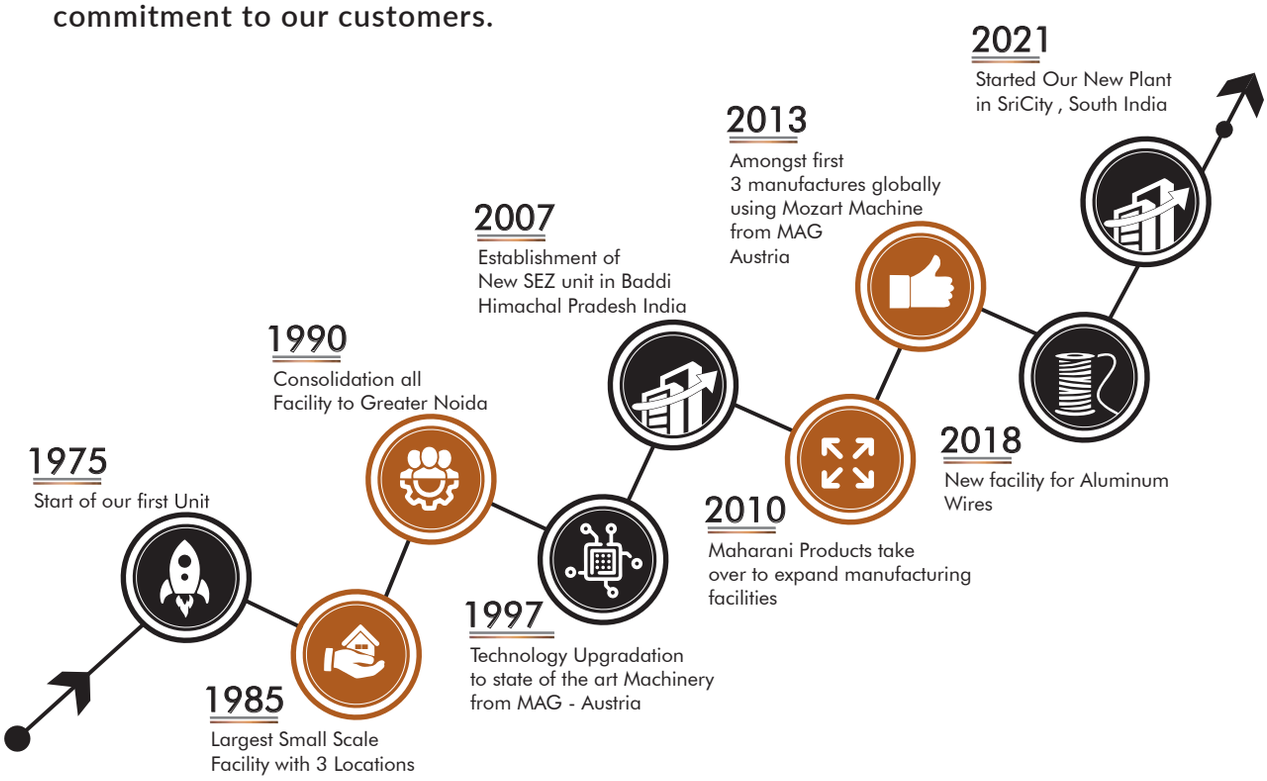
Mr. Sameer Agarwal joined G.K. Winding Wires Limited as an Executive Director in 2005 and since then the brand has seen a renewed focus on technology upgradation, new customer development and expansion.

An entrepreneur par excellence, he has put brand GEEKAY on the path to consistent double digit growth.

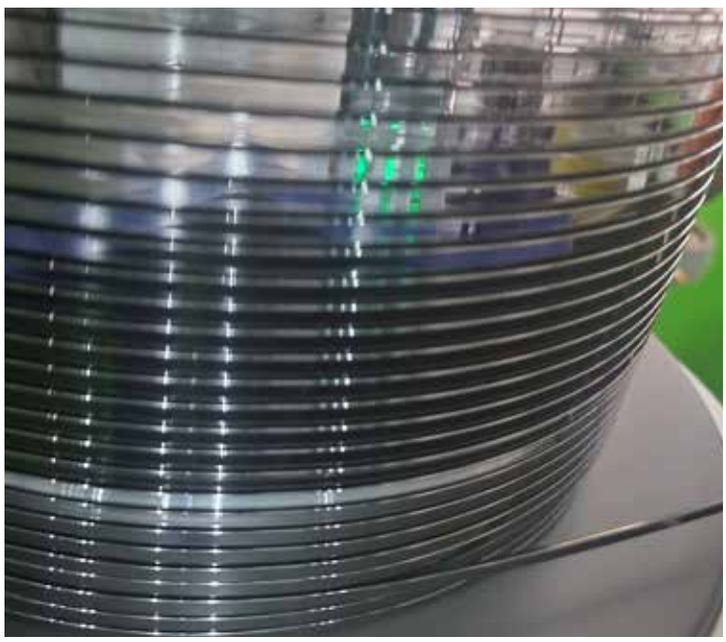
SAMEER AGARWAL
Managing Director
B.E. (Delhi College of Engineering), PGDBM (XLRI, Jamshedpur)

OUR JOURNEY

From humble beginnings 5 decades ago, to becoming a leader in the Winding Wires industry in India, our journey has been the result of incredible entrepreneurship, long term vision, deep rooted values, continuous investments in technology and capacity development, a focus on quality and systems and a deep partnership and commitment to our customers.



OUR PRODUCTS



The GEEKAY brand is well known for its high quality range of Copper & Aluminium Enamelled Winding Wires, made with 100% virgin materials using world-class technology at our state of the art manufacturing plants.

Our products are available in industry standard specifications, as well as, can be customized to meet the unique needs of our customers. All our products meet international quality specifications and are UL certified.

OUR CUSTOMER SEGMENTS

At GEEKAY, we have always believed in making trusted partnerships and for us our customers are our credentials. Over the past 5 decades, our brand has become a symbol of quality and trust for leading OEMs and Motor Manufacturers across a wide variety of industries:

- Automobiles (4 wheelers & 2 wheelers)
  - Auto Electricals
  - Starters
  - Alternators
  - Small Motors
  - Electric Vehicles
- Fans & Home Appliances
- Pumps & Motors
- Electricals & Electronics
- Capital Goods (Power & Transformers)
- Power Tools

Winding wires (also called Magnet Wires) are used to generate a magnetic field when current flows through them and this helps in conversion of electrical energy into other forms of energy like motion, sound, light, etc and vice versa.

Winding wires are basically classified by

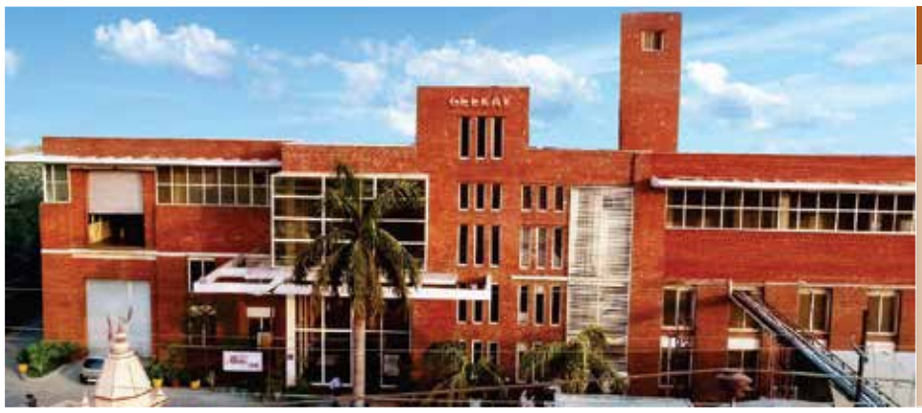
- Metal type
- Conductor size and insulation thickness
- Type of insulation – this in turn depends on thermal class required and application of the wire

The following are important characteristics of the wire

- Dimensional properties (Conductor and overall Diameter)
- Mechanical properties (Elongation, Springback, Coefficient of Friction)
- Electrical properties (Pin Hole, Break down Voltage)
- Thermal properties (Heat Shock, Cut Through)
- Insulation quality (Abrasion Resistance, Flexibility)
- Chemical properties (Resistance to Solvents that may be there in the application surroundings – Transformer Oil, Refrigerant, Water)

All these characteristics are essential. However, a wire cannot excel in all the properties in the same product, hence it is necessary to understand the application and relative importance of each of the characteristics in order to be able to choose the right product. Inline with the same, at GEEKAY we have a system driven, technology based and innovative solutions approach to help get maximum performance at the most economical cost.

Property of Wire	Testing Concept	Impact on final product	Controls at GEEKAY
Conductor Diameter & Over all Diameter	Testing of wire diameter before and after removing insulation	Wire with incorrect dimensions would result in: - Resistance of the wound coil not ok - Electrical properties including BDV, Pin hole, etc. not ok	Finely controlled pneumatic tension controllers Inline diameter measurement Use of diamond dies for drawing as well as enameling
Hardness in the Wire	Combination of mechanical properties	A hard wire will have: - Difficulty in insertion of coil after winding - Scratches observed during insertion	With years of experience, we have a best combination of mechanical properties suitable for best ease of application. We perform special indiginous tests on the wires and apply special kind of lubrication for obtaining the best fill factor
Surface Defect	Visual test, inline roughness detectors	Affects electrical properties and shortens life of the product	Careful control of dies, cleaning of conductor, choice of wire enamel, control of enamel viscosity during process
Abrasion Resistance	This depends of mechanical strength of coating. The force required to scratch the insulation is calculated in measuring abrasion resistance	Wire with poor abrasion resistance may get scratched during winding leading to failure of insulation	Use of most advanced tangent delta instruments from MAG and AMPAC to measure degree of cure of the wire
Flexiblity	The wire is pre-elongated to a specified value and bent as per requirement. Thereafter the insulation must not crack.	Poor flexibility will result in cracks in insulation during winding process wherein there are various mechanical stresses induced on the wire.	
Concentricity of Insulation	Make a mould and check for insulation thickness on all sides of the conductor	If the insulation is not uniform the life of final product is compromised	Concentricity measurement, Glycerine Break down Voltage Test
Heat shock, Cut Through (Softening Resistance)	To test these termal properties - thermal and mechanical stresses are simultaneously put on the wire and testing is done for failure of insulation	If thermal properties are not ok - the life of the product and ability to sustain under extreme conditions is poor	Use of most advanced tangent delta instruments from MAG and AMPAC to measure degree of cure of the wire Choice of the right insulation from reputed sources
Electrical Properties like Pin Hole and Break Down Voltage	Wire is subjected to a certain voltage and leakage current or point of short circuit is measured	Final coil is subjected to voltage and current and poor electrical properties may lead to faliure of final product in field	Careful process controls & inline testing for pin holes



UNIT I : Greater Noida

Total Area	: 10,000 M^2
Covered Area	: 1,00,000 SFT

UNIT II : Greater Noida

Total Area	: 7,000 M^2
Covered Area	: 1,00,000 SFT

UNIT III : SriCity (A.P)

Total Area	: 20 ,000 M^2
Covered Area	: 2,50,000 SFT

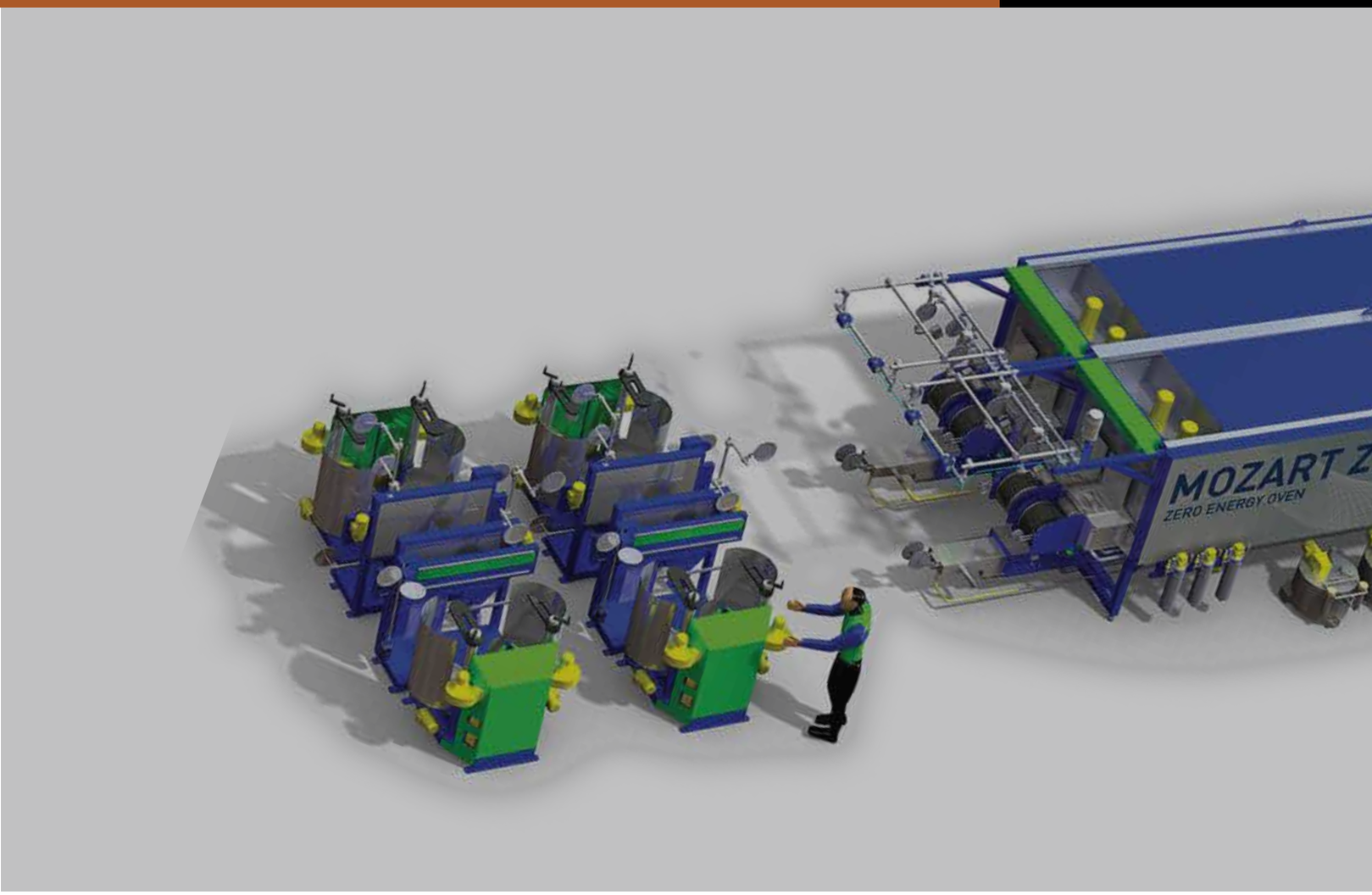
IV: Baddi (H.P)

Total Area	: 2,800 M^2
Covered Area	: 30,000 SFT

World Class Quality Certifications

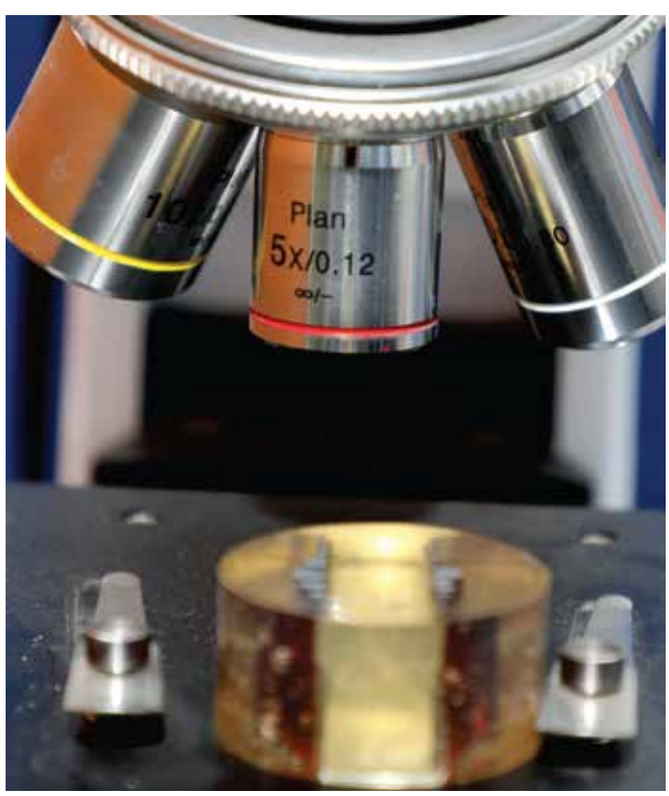
Our products have consistently received A+ ratings from our customers and is reflected in the fact that we haven't lost a customer since 1975. We're a DOL supplier for major automotive OEMs such as Denso, Honda, LG, Subros among many other, winning their trust for a really long time.

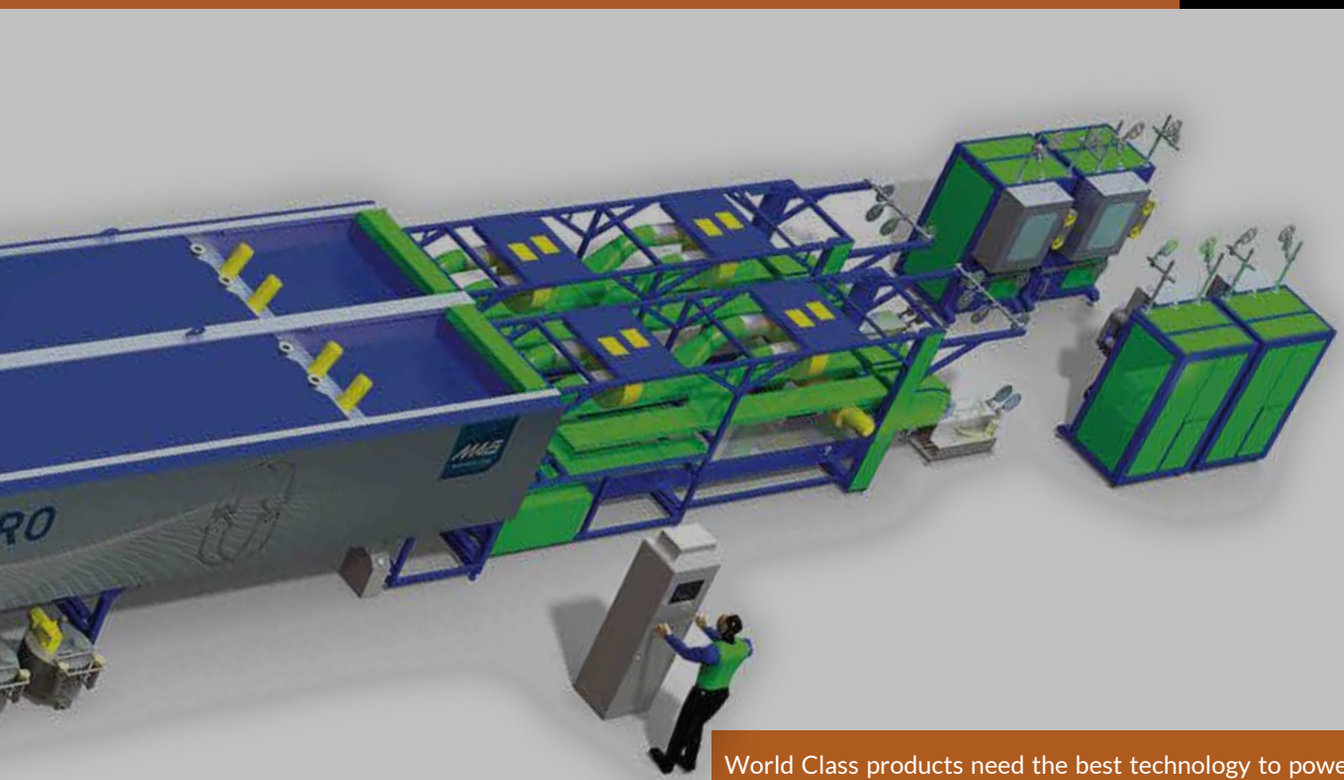
Awards



Special features for round wire

- Provision to make Grade 3 and more for better mechanical properties
- Single line – Single Oven manufacturing for better consistency
- Digitization at its best with real time statistica process control
- Inline pin holes and surface detection system
- Upto 5 different types of wire enamel can be used

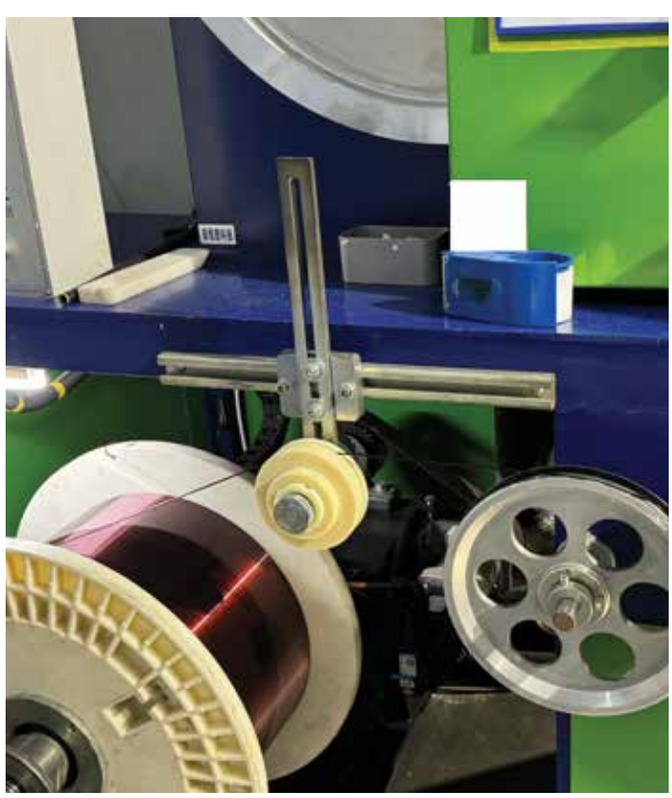




World Class products need the best technology to power them. At GEEKAY, we have been the pioneers to use the most modern, world class winding wire technology using machinery from reknowned global suppliers. Our manufacturing technology has evolved as per the latest industry trends as we believe that innovation is a way of life for us at GEEKAY.

Special features of flat wires (for EV)

- Inline drawing and rolling mill
- Real time surface and dimension measurement
- Best in class consistency of insulation on all sides
- Digitization at its best with real time statistical process control
- Camera based AI for surface detection



*As compared to traditional enameled magnet wire

Best In Class Quality Standards

At GEEKAY, quality is a way of life and we strive hard to ensure that we follow quality processes and systems in all that we do, to deliver the best in class products for your needs. The GEEKAY Seal of Quality is our Trust Mark for your peace of mind.

Inline Testing & Quality Control Process

Tan Delta

PDIV

Reciprocating Abrasion

Surface Detection

At GEEKAY, we have established our own set of standards which are more stringent that the standards set by our customers and we try to continuously improve on the same. The idea is to continuously improve the product quality and make a better and more reliable product. This is only possible by implementation of a very strict ILO (Incoming, Line and Outgoing) quality control system and having rigorous analysis and reviews on a regular basis. We also have world class inline diameter and pin hole measurement in our process for real time monitoring of product quality.

Product Technical Specifications

Type	Enamel used	Temperature index	Standard (Cu)	Standard (Al)	Advantages	Operational Precautions	Applications	
PEW	Polyester Enamelled wire	130°C			Good electrical characteristics. Good heat resistance. Good solvent resistance.	Mediocre resistance to thermal shock. Poor resistance to hydrolytic degradation; care must be taken when used in sealed equipment.	1.General purpose motors 2.Magnet coils	PE/PEI/PEI+PAI
PEW	Polyester Enamelled wire	155°C	IEC 60317-3, NEMA-MW5C, JIS-3202					
NY-PEW	Polyester + Nylon wire	155°C	MW 24-C	MW 24-A	Good surface slip characteristics; suited for high-speed machine winding. Good thermal shock resistance. Similar advantages to PEW.	Poor resistance to hydrolytic degradation; care must be taken when used in sealed equipment.	1.General purpose motors 2.Small motors	
EIW	Polyesterimide Enamelled wire	180°C	IEC 60317-8, NEMA-MW30C NEMA-MW72-C,JIS-3202	IEC 60317-15	Good heat resistance. Good thermal shock resistance. Mechanically strong coating. Excellent resistance to hydrolytic degradation. Excellent resistance to refrigerants.	Film detachment is difficult.	1.Class-F motors 2.Freon motors 3.Microwave oven transformers 4.Magnet coils for heat-resistance components 5.Motors for electrical equipment	
NY-EIW	PolyesterImide + Nylon wire	180°C	IEC 60317-22	MW 76-A	Good surface slip characteristics; suited for high - speed machine winding. Good thermal shock resistance. Similar advantages to EIW.	Poor resistance to hydrolytic degradation; care must be taken when used in sealed equipment.	1.General purpose motors 2.Small motors	
EIW-AIW	Polyestermide + Polyamideimide	200°C 220°C	IEC 60317-13, MW 35-C , MW 73-C MW 36-C, MW 38-C JIS-3202	IEC 60317-25, MW 35-A, MW 36-A MW 73-A	Good heat resistance. Good thermal shock resistance. Mechanically strong coating. Excellent resistance to hydrolytic degradation. Excellent resistance to refrigerants.	Film detachment is difficult.	1.Class-F motors 2.Freon motors 3.Microwave oven transformers 4.Magnet coils for heat-resistance components 5.Motors for electrical equipment	
AIW	Polyamideimide Enamelled wire	200°C 220°C	IEC 60317-26, IEC 60317-57 MW 81-C, JIS-3202		Mechanically strong coating. Good heat resistance. Good overload characteristics.	Coating flexibility is slightly inferior to PEW.	1.Transformers for heat-resistance equipment 2.Motors for electric tools 3.Hermetic motors 4.Motors for electrical equipment	
SB-EIW	Polyesterimide + Self bond wire	180°C	IEC 60317-37		Coils can be fixed without varnishing. Coil winding is possible while applying methanol and ethanol. Solder reflow after coil winding causes only slight coil deformation due to heat from reflow furnace. Coil winding is possible while applying methanol and ethanol.	Store wires in a cool, dark place away from heat and moisture.	1.Coils for flat motors 2.Clutch coils	SELF BONDING
SB-EIW-AIW	EIW + AIW + Self bond wire	180°C 200°C	IEC 60317-38, MW 102-C	MW 102-A	Coils can be fixed without varnishing. Wires can be bonded tightly together by heat produced with current flow or by heating in a thermostatic chamber Coil winding is possible while applying methanol and ethanol.	Store wires in a cool, dark place away from heat and moisture.	1.Coils	
SB-UEW	Polyurethane + Self bond wire	130°C	IEC 60317-2, MW 130-C		Coils can be fixed without varnishing. Coil winding is possible while applying methanol and ethanol. Solder reflow after coil winding causes only slight coil deformation due to heat from reflow furnace. Coil winding is possible while applying methanol and ethanol.	Store wires in a cool, dark place away from heat and moisture.	1.Coils for flat motors 2.Clutch coils	
SB-UEW	Polyurethane + Self bond wire	155°C	IEC 60317-35, MW 131C					
SB-UEW	Polyurethane + Self bond wire	180°C						
SB-PUPEI	Solderable PEI + Self bond wire	180°C	IEC 60317-36		Coils can be fixed without varnishing. Coil winding is possible while applying methanol and ethanol.	Store wires in a cool, dark place away from heat and moisture.	1.Coils for flat motors 2.Clutch coils	

Type	Enamel used	Temperature index	Standard (Cu)	Standard (Al)	Advantages	Operational Precautions	Applications	
PVA	Poly Vinyl Acetal	105°C 120°C	IEC 60317-1, MW 15C, JIS-3202-2 IEC 60317-12	MW 15A	Mechanically strong coating and good flexibility. Good thermal shock resistance. Strong in hydrolytic degradation.	Crazing prone Preheating prevents crazing from developing.)	1.Transformer	PVA
UEW	Polyurethane Enamelled wire	130°C	IEC 60317-4, MW 75-C		Soldering is possible without stripping off coating Excellent electrical characteristics with high frequency.	Coating is mechanically weak. Vulnerable to aromatic solvents. Crazing prone. (Preheating prevents crazing from developing.)	1.Coils for electronic equipment 2.Coils for communication equipment 3.Coils for electric meters 4.Micromotors 5.Magnet coils	POLYURETHANE/SELF SOLDERABLE
UEW	Polyurethane Enamelled wire	155°C	IEC 60317-20, MW 79-C, JIS 3202					
UEW	Polyurethane Enamelled wire	180°C	IEC 60317-51, MW 82-C JIS-3202					
PUPEI	Solderable PEI wire	180°C	IEC 60317-23, MW 77-C, JIS-3202		Soldering is possible without stripping off coating Excellent electrical characteristics with high frequency.	Soldering temp is higher than normal solderable enamels	1.Switchgear industry 2.Defence equipment	
NY-PUPEI	Solderable PEI + Nylon wire	180°C	MW 78-C		Good surface slip characteristics; suited for high-speed machine winding. Good thermal shock resistance. Similar advantages to PUPEI.	Poor resistance to hydrolytic degradation; care must be taken when used in sealed equipment.	1.Coils for flat motors 2.Clutch coils	
NY-UEW	Polyurethane + Nylon wire	130°C	IEC 60317-19, MW28-C	MW 28-A	Good surface slip characteristics; suited for high - speed machine winding. Good thermal shock resistance. Has all advantages of UEW wire	Poor resistance to hydrolytic degradation; care must be taken when used in sealed equipment.	1.Coils for electronic equipment 2.Coils for communication equipment 3.Coils for electric meters 4.Micromotors 5.Magnet coils	
NY-UEW	Polyurethane + Nylon wire	155°C	IEC 60317-21, MW 80-C	MW 80-A				
NY-UEW	Polyurethane + Nylon wire	180°C	IEC 60317-55 MW 83-C					
SL-EIW-AIW	EIW + AIW + Self lubricating PAI	200°C, 220°C	IEC 60317-13, MW 35-C, MW 73-C JIS-3202	IEC 60317-25, MW 35-A, MW36-A MW 73-A, JIS-3202	Excellent surface slip characteristics and mechanical strength; suited for high space - factor motors. Similar advantages to EIW-AIW	Film detachment is difficult.	1.High space factor motor 2.Freon motors 3.Motors for electrical equipment	SELF LUB

Self Bonding Enamelled Wires

Self Bonding Enamelled Wires are enamelled wires that allow coils to be bonded by heating or applying solvent during or after coil winding. A Self Bonding Enamelled Wire has an internal insulation layer & a bonding layer as the outside periphery. Self Bonding Enamelled Wires are provided with insulation properties at the insulation layer and coil fusion functionality at the fusion layer.

Fusion Method	Contents	Applications
Alcohol bonding method	Method in which alcohol is applied onto wires immediately before coil winding or coils are soaked into alcohol after the winding process. Further heating after applying alcohol improves adhesive strength. Be aware of foam formation caused by rapid heating.	Electrical equipment Brush-less motors
Oven bonding method	Oven bonding is achieved by heat-sealing coils in a heat chamber. Suitable for fusion of narrow wires that cannot be electrified due to excessively high resistance or thick wire coils that require a large current.	Electrical equipment Microwave ovens
Resistance heating method	Method in which Joule heat caused by an electric current melts and fuses bonding films. In the resistance heating method, the temperature increase depends on the radiation effect as influenced by the conductor diameter, film thickness, wire turns, coil shape, and surrounding environment. Energizing conditions must be determined after examining the test results.	Electrical equipment Microwave ovens

- Heating time depends on the coil size, shape, and fusion method.

Self Solderable Wires

When enamelled wires needs to connected to the terminals, the coating normally has to be removed either chemically or mechanically. With UEW (Urethane enamelled wire) or self solderable wires, we can perform the connections without removing the coating in a separate process.

This especially find application in electronics industry, smaller wire sizes or where chances of contamination due to separate removal of coating affect the product performance. These wires can be of the following types:

- Class 130°C, 155°C, Class 180°C depending on thermal resistance required in the final product
- Overcoat of Nylon can be provided for better windability and better abrasion resistance
- Overcoat of self bonding layer can be provided as per product needs – especially for coreless winding, need for impregnation (but varnishing not advisable or feasible)

Since general notes for handling wires have already been described, the below paragraphs describes some considerations for forming coils.

1. Considerations for Coil Forming

Dies are used for forming coils in many cases. A flaw on a die surface causes damage to the wire coating; die surfaces should be checked for damages.

2. Automatic Machine Winding

There is a trend toward direct coil winding to electric equipment by using an automatic coil winding machine. In general, there are a number of factors that make wires subject to harsh bending and stretching. Careful consideration must be given in advance to check coils with wires wound by a machine for damage or decreased dimensions.

3. Repairing at Corners

In some cases, coating wires are bent with a few millimeters of bend radius by using the coil of a rotating machine. It is inevitable that films are damaged at the corners to some extent; detailed maintenance is required as described earlier. It is desirable for repair materials to be identical to those of coating. In cases of inevitable situation, materials with similar mechanical, electric and thermal properties should be selected.

4. Handling after Coil Forming

Formed coils as mentioned above will become finished products through further stages - insulating, drying, and varnishing. These coils are assembled to stators or rotors. Extra care must be exercised to check for deformed coil shape and damaged coating during transportation or other handling processes down to the wire mounting process.

This requires each worker to pay close attention and to be ingenious in arranging and placing coils or even to use appropriate tools as necessary. Coils shall be stored away from dust particles (particularly metal powder) and moisture.

There is a recent trend toward omitting preliminary drying. However, due to the presence of strain, sweat, or moisture from enamel coatings in winding wires, preliminary drying should be performed sufficiently to improve insulation properties.

5. For Aluminum Conductor Magnet Wires

When winding a coil by a coil winding machine, appropriate tension must be given to a wire. Therefore, a tension device, which also serves as a corrector of wire bending, is put into use. It is desirable that the pressure surface should not be a slide surface but a roll surface and it is important that the tension strength be selected to minimize wire stretching. Special care must be taken with narrow wires.

- **Precautions about Tension Device**

Since aluminum conductors have a low tensile strength, the tension device for these conductors should be about 30% or less than that of copper wires. A higher tension increases stretching, thereby deteriorating the properties.

- **Precaution in Automatic Machine Winding**

Aluminum conductors may be stretched locally by 10% or more due to impact force during machine winding; special care must be exercised.

- **Precaution in Moulding Process**

An aluminum conductor is soft and may deform before its coating is damaged; special care must be taken with pressurizing method during coil moulding.

STORAGE PERIOD

If magnet wires are stored properly in accordance with above, there will be no deterioration in properties even after 10 years or more have passed. However, if wires are not stored properly, for the wires for which more than three years have passed since delivery, be sure to examine the characteristics and check for problems before use.

If you have any questions, please contact us.

Diameter and Tolerance of Enamelled Round Winding Wire (Basis: IS 13730-0-1 IEC 60317-0-1)

Size in SWG	Conductor Dia (in mm)			Grade - 1 (in mm)		Grade - 2 (in mm)		Grade - 3 (in mm)		Resistance at20°C (Cu) Ohms per metre		Resistance at 20°C (Al) Ohms per metre		Conductor Wtin Kg/Km (Cu)	Conductor Wtin Kg/Km (Al)
	Min.	Nominal	Max.	Min. Increase	Max. Overall Dia	Min. Increase	Max. Overall Dia	Min. Increase	Max. Overall Dia	Min.	Max.	Min.	Max.		
8	4.023	4.064	4.104	0.047	4.152	0.089	4.197	0.119	4.240	0.0013	0.0014	0.0021	0.0022	115.36	35.04
9	3.622	3.657	3.693	0.047	3.745	0.087	3.790	0.116	3.828	0.0016	0.0017	0.0026	0.0027	93.41	28.37
10	3.218	3.251	3.284	0.046	3.336	0.084	3.380	0.114	3.421	0.0020	0.0021	0.0033	0.0034	73.82	22.42
11	2.915	2.946	2.976	0.045	3.029	0.084	3.072	0.127	3.112	0.0024	0.0026	0.0040	0.0042	60.62	18.41
12	2.615	2.641	2.667	0.043	2.722	0.081	2.764	0.123	2.803	0.0030	0.0032	0.0050	0.0052	48.72	14.8
13	2.313	2.336	2.359	0.042	2.415	0.079	2.455	0.119	2.492	0.0039	0.0041	0.0064	0.0066	38.12	11.58
14	2.012	2.032	2.052	0.041	2.108	0.077	2.147	0.116	2.184	0.0051	0.0055	0.0084	0.0088	28.84	8.76
15	1.810	1.829	1.848	0.040	1.903	0.075	1.941	0.113	1.977	0.0063	0.0067	0.0104	0.0108	23.37	7.1
16	1.607	1.626	1.643	0.039	1.698	0.073	1.735	0.110	1.770	0.0080	0.0085	0.0132	0.0137	18.47	5.61
17	1.407	1.422	1.437	0.038	1.492	0.071	1.528	0.107	1.562	0.0105	0.0111	0.0172	0.0179	14.12	4.29
18	1.206	1.219	1.232	0.035	1.285	0.067	1.318	0.100	1.350	0.0142	0.0151	0.0234	0.0244	10.38	3.15
19	1.005	1.016	1.027	0.034	1.080	0.065	1.113	0.098	1.144	0.0205	0.0217	0.0337	0.0351	7.21	2.19
20	0.904	0.914	0.924	0.034	0.976	0.063	1.008	0.095	1.038	0.0253	0.0269	0.0416	0.0434	5.84	1.77
21	0.804	0.813	0.822	0.032	0.872	0.060	0.902	0.090	0.931	0.0319	0.0340	0.0525	0.0549	4.62	1.40
22	0.703	0.711	0.719	0.030	0.766	0.056	0.795	0.085	0.822	0.0418	0.0444	0.0687	0.0718	3.53	1.07
23	0.604	0.610	0.616	0.027	0.659	0.050	0.684	0.075	0.708	0.0569	0.0602	0.0936	0.0973	2.60	0.79
24	0.553	0.559	0.565	0.025	0.605	0.047	0.629	0.071	0.652	0.0676	0.0718	0.1112	0.1161	2.18	0.66
25	0.502	0.508	0.514	0.025	0.554	0.047	0.578	0.071	0.601	0.0816	0.0871	0.1344	0.1409	1.80	0.55
26	0.452	0.457	0.462	0.024	0.501	0.045	0.523	0.067	0.544	0.1011	0.1075	0.1663	0.1738	1.46	0.44
27	0.412	0.417	0.422	0.022	0.458	0.042	0.480	0.064	0.500	0.1212	0.1293	0.1994	0.2091	1.21	0.37
28	0.371	0.376	0.381	0.021	0.417	0.040	0.435	0.060	0.454	0.1487	0.1595	0.2446	0.2579	0.99	0.30
29	0.341	0.345	0.349	0.020	0.382	0.038	0.401	0.057	0.418	0.1772	0.1888	0.2915	0.3053	0.83	0.25
30	0.311	0.315	0.319	0.019	0.349	0.035	0.367	0.053	0.384	0.2121	0.2269	0.3489	0.3671	0.69	0.21
31	0.291	0.295	0.299	0.019	0.329	0.035	0.347	0.053	0.364	0.2414	0.2592	0.3971	0.4192	0.61	0.18
32	0.270	0.274	0.278	0.018	0.306	0.033	0.323	0.050	0.339	0.2792	0.3011	0.4594	0.4870	0.52	0.16
33	0.250	0.254	0.258	0.018	0.286	0.033	0.303	0.050	0.319	0.3242	0.3512	0.5333	0.5680	0.45	0.14
34	0.230	0.234	0.238	0.017	0.265	0.032	0.281	0.048	0.296	0.3809	0.4149	0.6267	0.6711	0.38	0.12
35	0.210	0.213	0.216	0.015	0.241	0.029	0.255	0.043	0.269	0.4625	0.4978	0.7609	0.8050	0.32	0.10
36	0.190	0.193	0.196	0.014	0.219	0.027	0.232	0.039	0.245	0.5618	0.6081	0.9241	0.9834	0.26	0.08
37	0.170	0.173	0.176	0.013	0.197	0.025	0.210	0.036	0.222	0.6967	0.7596	1.1461	1.2284	0.21	0.06
38	0.149	0.152	0.155	0.012	0.174	0.023	0.186	0.033	0.197	0.8982	0.9888	1.4777	1.5991	0.16	0.05
39	0.129	0.132	0.135	0.011	0.152	0.021	0.162	0.030	0.171	1.1841	1.3192	1.9480	2.1334	0.12	0.04
40	0.119	0.122	0.125	0.010	0.141	0.019	0.151	0.028	0.160	1.3811	1.5502	2.2721	2.5070	0.10	0.03
41	0.109	0.112	0.115	0.009	0.130	0.017	0.139	0.026	0.147	1.6320	1.8480	2.6844	2.9881	0.09	0.03
42	0.099	0.102	0.105	0.009	0.119	0.017	0.128	0.026	0.136	1.9570	2.2400	3.2201	3.6222	0.07	0.02

Diameter and Tolerance of Enamelled Round Winding Wire (Basis: IS 13730-0-1 IEC 60317-0-1)

Conductor Dia (in mm)	Conductor Tolrence (in mm)	Grade 1 (in mm)		Grade 2 (in mm)		Grade 3 (in mm)		Resistance at 20°C (Cu) Ohms per metre		Conductor Wt in Kg/Km (Cu)	Conductor Wt in Kg/Km (Al)
		Min. Increase	Max. Overall Dia	Min. Increase	Max. Overall Dia	Min. Increase	Max. Overall Dia	Min.	Max.		
0.07	0.003	0.007	0.084	0.012	0.091	0.018	0.097	3.9410	4.7470	0.035	0.011
0.08	0.003	0.008	0.094	0.014	0.101	0.020	0.108	3.1330	3.7030	0.045	0.014
0.09	0.003	0.008	0.105	0.015	0.113	0.022	0.120	2.4950	2.9000	0.057	0.017
0.10	0.003	0.008	0.117	0.016	0.125	0.023	0.132	2.0340	2.3330	0.070	0.021
0.11	0.003	0.009	0.130	0.017	0.139	0.026	0.147	1.6320	1.8480	0.088	0.027
0.12	0.003	0.010	0.144	0.019	0.154	0.028	0.163	1.3170	1.4750	0.109	0.033
0.13	0.003	0.011	0.152	0.021	0.162	0.030	0.171	1.3192	1.1841	0.122	0.037
0.14	0.003	0.011	0.160	0.021	0.171	0.030	0.181	1.0550	1.1700	0.137	0.042
0.16	0.003	0.012	0.182	0.023	0.194	0.033	0.205	0.8122	0.8906	0.179	0.054
0.18	0.003	0.013	0.204	0.025	0.217	0.036	0.229	0.6444	0.7007	0.226	0.069
0.20	0.003	0.014	0.226	0.027	0.239	0.039	0.252	0.5237	0.5657	0.279	0.085
0.22	0.003	0.015	0.252	0.029	0.266	0.043	0.280	0.4188	0.4495	0.350	0.106
0.25	0.004	0.017	0.281	0.032	0.297	0.048	0.312	0.3345	0.3628	0.437	0.133
0.28	0.004	0.018	0.312	0.033	0.329	0.050	0.345	0.2676	0.2882	0.548	0.166
0.32	0.004	0.019	0.349	0.035	0.367	0.053	0.384	0.2121	0.2270	0.693	0.210
0.36	0.004	0.020	0.392	0.038	0.411	0.057	0.428	0.1674	0.1782	0.880	0.267
0.40	0.005	0.021	0.439	0.040	0.459	0.060	0.478	0.1316	0.1407	1.118	0.339
0.45	0.005	0.022	0.491	0.042	0.513	0.064	0.533	0.1042	0.1100	1.414	0.430
0.50	0.005	0.024	0.544	0.045	0.566	0.067	0.587	0.0846	0.0896	1.746	0.530
0.56	0.006	0.025	0.606	0.047	0.630	0.071	0.653	0.0674	0.0715	2.190	0.665
0.63	0.006	0.027	0.679	0.050	0.704	0.075	0.728	0.0534	0.0564	2.772	0.842
0.71	0.007	0.028	0.762	0.053	0.789	0.080	0.814	0.0420	0.0444	3.521	1.069
0.80	0.008	0.030	0.855	0.056	0.884	0.085	0.911	0.0331	0.0350	4.470	1.358
0.90	0.009	0.032	0.959	0.060	0.989	0.090	1.018	0.0261	0.0277	5.658	1.718
1.00	0.010	0.034	1.062	0.063	1.094	0.095	1.124	0.0212	0.0224	6.985	2.121
1.12	0.011	0.034	1.184	0.065	1.217	0.098	1.248	0.0168	0.0178	8.762	2.661
1.25	0.013	0.035	1.316	0.067	1.349	0.100	1.381	0.0135	0.0143	10.914	3.315
1.40	0.014	0.036	1.468	0.069	1.502	0.103	1.535	0.0110	0.0114	13.691	4.158
1.60	0.016	0.038	1.670	0.071	1.706	0.107	1.740	0.0083	0.0087	17.882	5.431
1.80	0.018	0.039	1.872	0.073	1.909	0.110	1.944	0.0066	0.0069	22.631	6.873
2.00	0.020	0.040	2.074	0.075	2.112	0.113	2.148	0.0053	0.0056	27.940	8.486
2.24	0.022	0.041	2.316	0.077	2.355	0.116	2.392	0.0042	0.0044	35.048	10.644
2.50	0.025	0.042	2.578	0.079	2.618	0.119	2.656	0.0034	0.0036	43.656	13.259
2.80	0.028	0.043	2.880	0.081	2.922	0.123	2.961	0.0027	0.0028	54.762	16.632
3.15	0.032	0.045	3.233	0.084	3.276	0.127	3.316	0.0021	0.0022	69.309	21.050
3.55	0.036	0.046	3.635	0.086	3.679	0.130	3.721	0.0017	0.0018	88.028	26.735
4.00	0.040	0.047	4.088	0.089	4.133	0.134	4.176	0.0013	0.0014	111.760	33.943
4.50	0.045	0.049	4.591	0.092	4.637	0.138	4.681	0.0010	0.0011	141.446	42.959
5.00	0.050	0.050	5.093	0.094	5.141	0.142	5.186	0.0008	0.0009	174.625	53.036

GEEKAY WINDING WIRES

Exceeding Expectations

The automotive industry is going for smaller and more efficient traction motors. GK has developed products to meet exactly this requirement of the automotive and EV industry with wires that are able to withstand high voltage.

High voltage wires creates high heat. This needs wires that can withstand

- Good heat resistance
- Without compromising flexibility
- High PDIV

We in turn are able to offer wires that are

- Highly customized with respect to

- Coating thickness upto 300 microns
- Aspect ratio as low as 1:1
- Good ATF and oil resistance
- Choice of raw material – Electrolytic Tough Pitch (ETP) or Oxygen Free (OF)

- High temperature

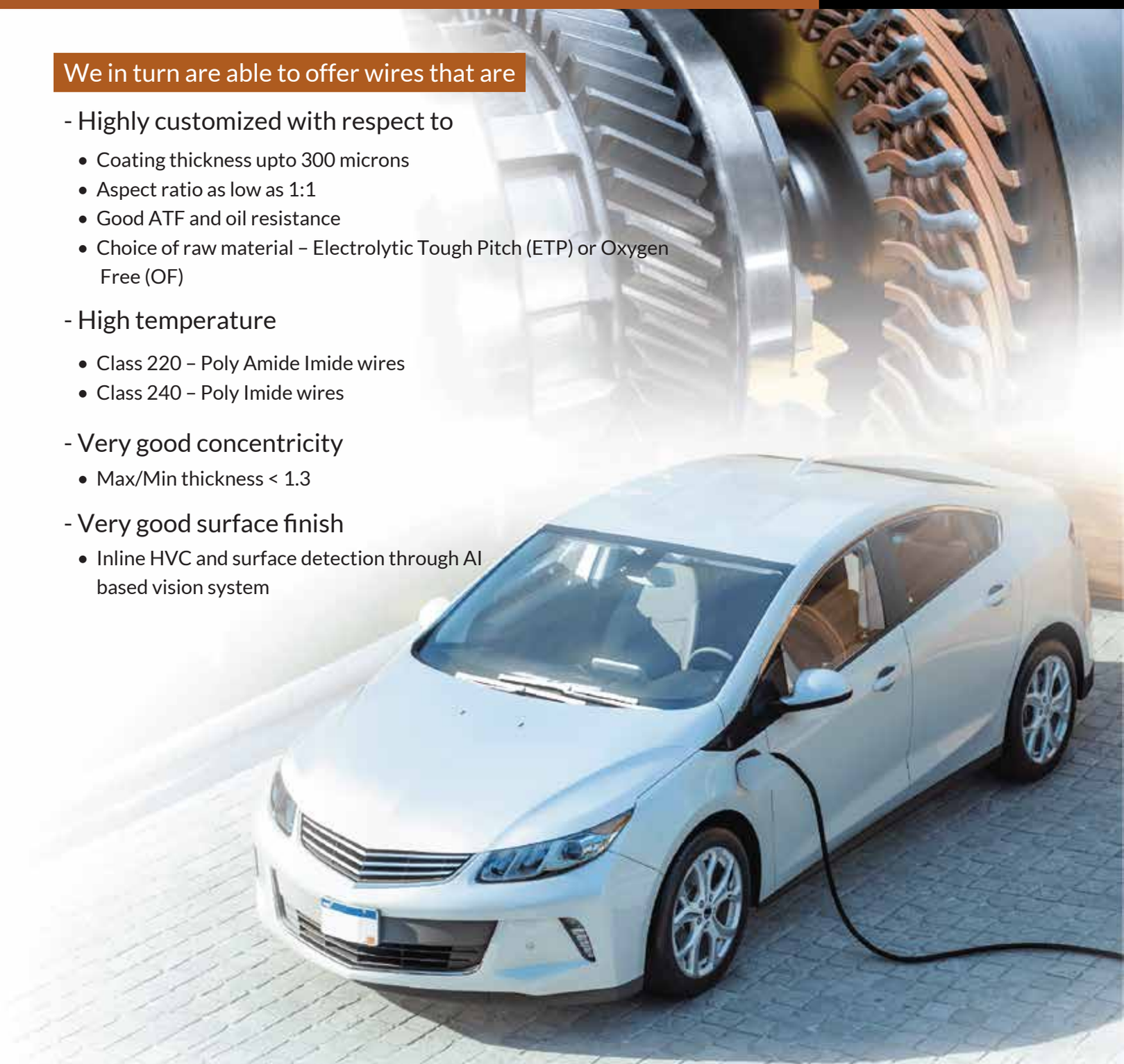
- Class 220 – Poly Amide Imide wires
- Class 240 – Poly Imide wires

- Very good concentricity

- Max/Min thickness < 1.3

- Very good surface finish

- Inline HVC and surface detection through AI based vision system



Special Inspection to ensure reliability of wire

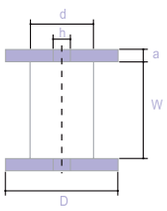
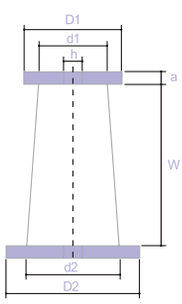
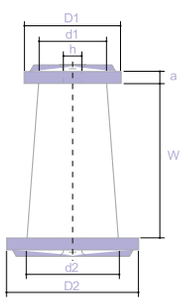
- Inline surface detection through AI technology
- Coefficient of friction for flat wires
- World class Tangent Delta devices
- Concentricity measurement
- PDIV and Corona resistance measurement

	FLAT 180°	FLAT 200°	FLAT 220	FLAT 240
CLASS	**180°**	**200°**	**220°**	**240°**
STANDARD	IEC 60317-28	IEC 60317-29	IEC 60317-58	IEC 60317-58
INSULATION	Polyester-imide coated.	Polyester-imide,over coated with polyamide-imide	Base-coat: Polyimide-imide	Base coat: Polyimide
PROPERTIES	High mechanical strength, strong adhesion of enamel to copper conductor, Excellent hydrolysis & oil resistance.	High heat resistance.	High heat resistance.	High heat resistance.
		Very good resistance to transformer oils.	Very good resistance to transformer oils.	Very good resistance to transformer oils.
		Very good resistance to typical solvent.	Very good resistance to typical solvent.	Very good resistance to typical solvent.
		Freon resistant.	Freon resistant.	Freon resistant.
		Excellent resistance to mechanical stress.	Excellent resistance to mechanical stress.	Excellent resistance to mechanical stress.
				High values for PDIV.
				PD occurs at a higher voltage level than for standard wire.
TEMPERATURE INDEX	≥180°	≥200°	≥220°	≥240°
HEAT SHOCK	≥200°	≥220°	≥240°	≥260°
REELS AND PACKAGING	As per customer requirement			

High Voltage Winding Wire – Performance with 150-200 microns of film covering

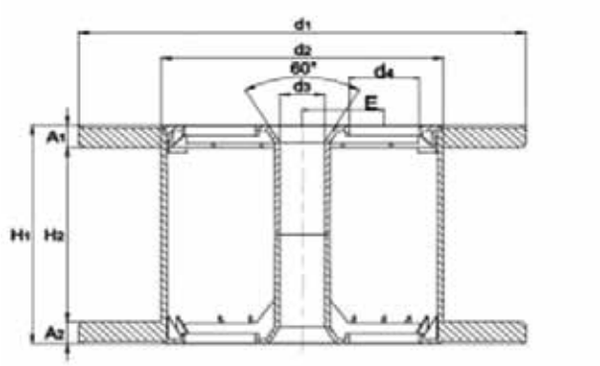
PROPERTIES			
	TEST DETAILS	**TYPICAL PERFORMANCE***	**REQUIRED PERFORMANCE****
THERMAL			
Thermal Cycle	>2,000 cycles @-40°C~150°C	No cracks	No cracks
Thermal Endurance	20,000hours per ASTM D 2307	241°C	240°C
Thermoplastic Flow	Crossing method, 5°C/minute rise rate	350°C, 2kg weight	450°C, 2kg weight
PHYSICAL			
Abrasion Resistance	Unidirectional Scrape	1,700g	> 710g min
	Repeated Scrape	180 strokes, 700g	-
Adherence and Flexibility	(1.0 × width diameter) bending radius = wire width/2.	180° edgewise bend, no crack	(1.0 × width diameter) bending radius = wire width/2.
Elongation	Elongate to break	> 40%	> 32%
Spring back	Mandrel wrap thick bend	3°	< 5°
ELECTRICAL			
Continuity	30m, graphite fiber brush	0 fault @ 1,500 VDC	< 5 fault @ 1,500 VDC
Dielectric Room Temperature	Allow pairs	10,000 volts	> 5,700 volts

Spool Dimensions for Winding Wires

Type	Bobbin	Flange Diameter	Barrel Diameter	Inside width	Flange Thickness	Hole Diameter	Maximum Weight of Enamelled Copper Wire per Spool	Maximum Weight of Enamelled Aluminium Wire per Spool
		D (mm)	D (mm)	W (mm)	A (mm)	H (mm)	Kg.	Kg.
Cylindrical Plastic Spool	GK25	265	155	165	15	45	25	-
	DIN160	160	100	128	16	22	7	-
	DIN200	200	125	200	20	22	14	5
	DIN250	250	160	200	20	22	22	7
	PT-4	D1 124 D2 140	D1 74 D2 86	170	15	26	4	-
	PT-10	D1 160 D2 180	D1 96 D2 110	200	15	30	10	3
	PT-15	D1 180 D2 200	D1 96 D2 110	198	15	30	15	5
	PT-25	D1 215 D2 230	D1 110 D2 130	250	15	34	25	7
	PT-60	D1 270 D2 300	D1 150 D2 180	350	25	45	60	20
Plastic Taper Spool	PT-45	D1 236 D2 250	D1 140 D2 160	335	32	100	40	15
	PT-100	D1 300 D2 315	D1 180 D2 200	425	38	100	90	30
	PT-200	D1 375 D2 400	D1 224 D2 250	530	50	100	190	60
	PT-400	D1 475 D2 500	D1 280 D2 315	670	65	100	400	-

Any other specific spool requirements can be met on request

Spools For Rectangular Wires



Specification	d1 (mm)	d2 (mm)	H1 (mm)	H2 (mm)	A1 (mm)	A2 (mm)	d4 (mm)	E (mm)	Wt per spool (Cu)
PC 355	355	224	200	160	20	20	26	65	40
PN 400	400	200	290	250	20	20	20	67.5	60
PC 500	500	315	250	180	35	35	26	85	100
PC 600	600	400	338	280	29	29	25	116	200

NOTES

Quality that inspires Trust

- Highest Quality
- World Class Technology
- 100% Customer Satisfaction
- Customer Centric Solutions Approach

Technology...Quality...Service...these three elements work in harmony
to deliver the product excellence you can expect from us at GEEKAY

GEEKAY

WINDING WIRES

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